



**Trends in Flue-Cured Tobacco Farming.** By Verner N. Grise. National Economics Division, Economics and Statistics Service, U.S. Department of Agriculture. Agricultural Economic Report No.470 .

## **Abstract**

Mechanical harvesting, bulk barn curing, and acres of flue-cured tobacco produced per farm increased substantially during 1972-79, while labor used to harvest tobacco dropped by 35 percent, from 72 million to 47 million hours. Only 16 percent of the tobacco producers owned all the quota they produced in 1979; 63 percent rented some land with quota and 43 percent leased some quota. This study identifies trends in flue-cured tobacco farming in four Southeastern States. The amount of labor used to harvest flue-cured tobacco in the next few years will likely drop as mechanical harvesting and acres per farm increase.

**Keywords:** Flue-cured tobacco, farm operators, tobacco acreage, mechanical harvesters, bulk barns, labor use.

## **Preface**

A number of studies within the U.S. Department of Agriculture (USDA) and at State universities were conducted in the early seventies on changes within the flue-cured tobacco industry and their effect on people and communities. The work was jointly undertaken by USDA and the U.S. Department of Labor (USDL). The USDL portion of the work was conducted through a contract with North Carolina State University. The USDA studies examined the state of technology in the flue-cured tobacco industry, the likely effects of future technological changes on the demand for labor within the industry, and economic conditions in the flue-cured tobacco region and their influence on human resource adjustments. The USDL studies examined labor supply and household earnings of tobacco harvest workers. Findings of these studies, which are summarized in the references at the end of this report (see items 2, 3, 4, and 6), are the basis for the trends analyzed here.

## **Acknowledgments**

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## **Summary**

Total labor used to harvest flue-cured tobacco dropped 35 percent during 1972-79, from 72 million to 47 million hours, as farmers adopted labor-saving bulk barns and mechanical harvesters. Nineteen percent of the acreage was harvested by mechanical harvesters and 61 percent was cured in bulk barns in 1979, compared with 1 and 8 percent, respectively, in 1972.

This study examines these and other trends in flue-cured tobacco farming in the four regions of Georgia, North Carolina, South Carolina, and Virginia that grow 75 percent of all U.S. flue-cured tobacco. Impact of these trends is projected to 1985.

Flue-cured tobacco management units in the study area averaged 13.8 acres of tobacco in 1979, up from 9.5 acres in 1972. The average size of units ranged from 10.8 acres in the Virginia-North Carolina Piedmont to 18.8 acres in the North Carolina Coastal Plain in 1979.

Only 23 percent of the tobacco producers owned all the land they farmed in 1979. Sixteen percent owned all the tobacco quota they grew. Sixty-three percent rented some land with quota and 43 percent leased some quota.

Many flue-cured tobacco farms in the study area have farm enterprises other than tobacco (primarily corn and beef cattle), although gross farm family income from tobacco in 1979 averaged 79 percent of total gross farm income.

About 27 percent of all flue-cured tobacco farmers worked off the farm in 1979, ranging from 17 percent in the North Carolina Coastal Plain and Georgia to 40 percent in the Virginia-North Carolina Piedmont. About 52 percent of the operator households had one or more members working off the farm.

Flue-cured tobacco farms are likely to continue to increase in size, as adoption of mechanical harvesters and bulk barns continues. An estimated 35 percent of the flue-cured acreage will be mechanically harvested by 1985, and essentially all the tobacco will be cured in bulk barns.

# Trends in Flue-Cured Tobacco Farming

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## Introduction

Flue-cured tobacco farming changed considerably during the seventies, as farms became larger and more mechanized. This trend is expected to continue during the eighties.

This report updates information about structural and technological changes on flue-cured tobacco farms from 1972-79, evaluates their ramifications, and provides some insight into potential changes in the eighties. Specifically, it looks at trends in the number of farms producing tobacco; changes in enterprise combinations, tenure of operators, and the age and education of operators; and changes in the methods of harvesting flue-cured tobacco.

Particular attention is given to the effect of changes in the methods of harvesting flue-cured tobacco on the type and quantity of labor used. Farms in four agricultural regions containing about three-fourths of the U.S. flue-cured production were surveyed in 1972 (fig. 1). Another survey of the same four agricultural regions was conducted in 1979.

Questionnaires were completed for 955 tobacco farm operators in the latest survey.<sup>1</sup> Information was collected on the size and organization of flue-cured tobacco management units, the methods of acquiring tobacco quota and other resources, the current tobacco harvesting systems, the type and quantity of labor used, and the dependence of farm operators on income from farm and nonfarm sources. The 1979 survey was designed to collect data that would be useful for estimating the costs of producing flue-cured tobacco. As a result, the structural data is not as detailed as the data in the 1972 study (2).<sup>2</sup>

<sup>1</sup>The term "farm" in this report is synonymous with management unit and operator unit. This definition of a farm is not consistent with the one specified in the census of agriculture. For census purposes, each sharecropper is a separate farm unit. In this study, all land farmed by sharecroppers is included with the operator's acreage and classified as a single management unit. This procedure results in fewer farms in the study regions than does the census definition.

<sup>2</sup>Italicized numbers in parentheses refer to items in the References section.

The specific objectives of this report are to:

- Evaluate the structure of flue-cured tobacco production units and compare changes during 1972-79.
- Determine the type and amount of labor-saving technology that has been adopted on flue-cured tobacco farms and appraise its effects on labor use.
- Evaluate future structural and technological changes in flue-cured tobacco production and harvest.

The geographic study area consists of four agricultural regions (called subregions by the census of agriculture) in four Southeastern States (fig. 1).

### **Pee Dee-Lumber River, North Carolina and South Carolina Census Subregion 16**

This area is located in the drainage basin of the lower Pee Dee River and its tributary, the Lumber River. Most of the subregion lies in the Coastal Plain, but a few tobacco-producing counties of the North Carolina Sand Hills are also included. Farmland is interspersed with large acreages of swamp or other poorly drained land. In the Sand Hills portion, much of the land is suitable only for forestry or nonagricultural uses. At one time, cotton predominated in the Pee Dee-Lumber River area, but little cotton is now grown and tobacco is the leading cash crop.

### **Coastal Plain, North Carolina Census Subregion 17**

The Coastal Plain of North Carolina is the most concentrated area of flue-cured tobacco production in the United States. It has ideal soil and climatic conditions. The sandy clay subsoils warm early and can be easily worked. Commercial cultivation of

## Farm Numbers and Tobacco Acreages

tobacco began in the 1890's. Once established, tobacco supplanted cotton as a principal source of farm income, and now accounts for a large percentage of all farm sales.

### **Piedmont of North Carolina and Virginia Census Subregion 18**

The Piedmont of North Carolina and Virginia is the Nation's oldest area for growing flue-cured tobacco. It ranks second to the Coastal Plain of North Carolina as the most important producer of tobacco, and is the center of the cigarette manufacturing industry. Tobacco is grown mostly on the light-textured soils of fine sand loam. The fields are often small and irregularly shaped and lie on uneven terrain, which varies from undulating to hilly, with mountainous portions in the Western Piedmont. Half the farmland remains in woods, mostly unpastured.

### **Georgia Census Subregion 29**

The Southern Georgia Coastal Plain was traditionally a cotton area. Today, major crops are

tobacco (introduced in the twenties), soybeans, and peanuts. This predominantly rural subregion is a diversified farming area. Many farms have livestock. Considerable land is devoted to pulpwood forests.

## **Farm Numbers and Tobacco Acreages**

As flue-cured tobacco farming has become more mechanized through the use of mechanical harvesters and bulk barns, the number of tobacco farms has declined and the tobacco acreage per farm has increased. Larger acreages of tobacco per farm are necessary to justify investment in labor-saving technology. While some producers have expanded, others have discontinued growing tobacco and retired, shifted to off-farm work, or shifted to alternative farm enterprises.

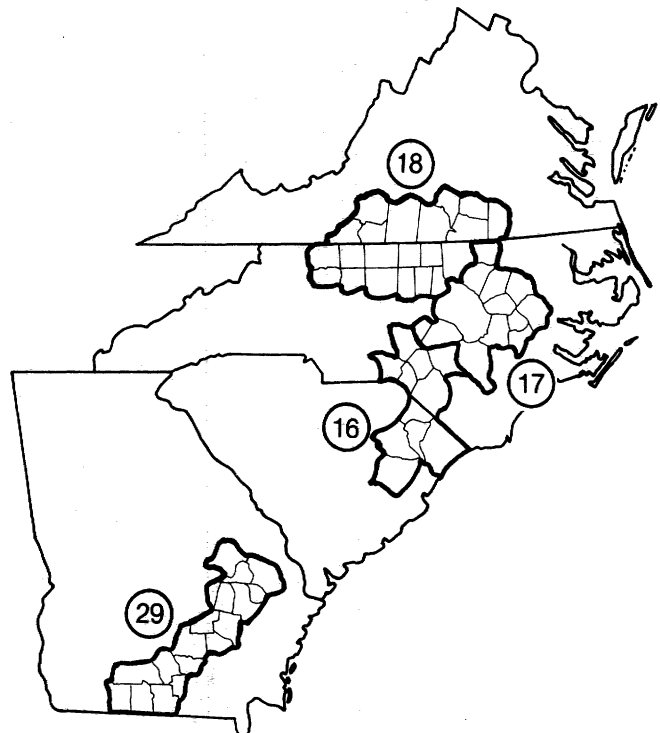
Flue-cured tobacco quotas are assigned to specific farms. Quotas can be leased and transferred to other farms that have flue-cured tobacco quota if the farms are in the same county.

Figure 1

### **Flue-cured tobacco production regions**

- ①⑥ Pee Dee-Lumber River, North Carolina-South Carolina
- ①⑦ Coastal Plain, North Carolina
- ①⑧ Piedmont, Virginia-North Carolina
- ②⑨ Georgia

Numbers refer to designated census of agriculture subregions



Quota values have been bid up with rising Federal price support levels as a result of the demand for quota to increase operating unit size. About 43 percent of the farmers leased-in quota in 1979 at an average cost of 39 cents per pound. The average lease cost ranged from 34 cents a pound in region 18 to 45 cents a pound in region 29.<sup>3</sup> Many tobacco allotment owners with alternative uses for their labor and land resources can earn more from leasing quota out than from growing tobacco themselves.

An average of 13.8 acres of tobacco was produced on 28,906 management units in the four study areas in 1979 (table 1), a 45-percent increase in acres of tobacco per unit from 1972. There has been a 30-percent decline in the number of farms during this period. The average tobacco acreage per farm unit ranged from 10.8 acres in the Piedmont to 18.8 acres in the Coastal Plain. Each management unit was comprised of an average of four individual tobacco quotas in 1979, reflecting considerable quota consolidation. Quota was most consolidated in the Coastal Plain and the least consolidated in the Piedmont.

The Piedmont has the most management units—39 percent of the area total. However, because of the smaller size of operations, lower quota pounds per acre, and lower yields, the Piedmont accounted for only 29 percent of the total tobacco production in 1979. The Coastal Plain had 30 percent of the operator units, but produced 41 percent of the tobacco.

Slightly over half the growers produced 9 acres of tobacco or more in 1979, compared with less than 40 percent with at least this much acreage in 1972 (table 2). The proportion growing 9.0 to 19.9 acres was slightly higher in 1979. The largest increase was in the proportion of growers producing 20 or more acres of tobacco, which more than doubled over the 7-year period. Please note that averages for all following tables are weighted based on the total number of farms or units reported in each region.

## Cropland Acreages and Enterprises

Tobacco farms averaged 114 acres of cropland in 1979, ranging from 47 acres in the Piedmont to 221 acres in Georgia (table 3). Average cropland per

<sup>3</sup>Rates cited are for leases for production. Marketing season leases averaged 44 cents per pound in 1979.

**Table 1—Flue-cured tobacco management units, quotas, and tobacco production, by region**

Item	Unit	Region				
		Pee Dee- Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Total/average, four regions
Farms:						
1979	Number	5,877	8,577	11,266	3,186	28,906
1972	do.	6,752	13,571	15,967	4,255	40,545
Acreage per farm:						
1979	Acres	13.2	18.8	10.8	11.5	13.8
1972	do.	10.9	11.2	7.7	8.7	9.5
Quota per farm:						
1979	Pounds	27,526	38,647	20,752	24,191	27,818
1972	do.	23,111	22,898	14,333	17,856	19,071
Individual quotas per farm:						
1979	Number	4.1	4.5	3.3	4.3	4.0
1972	do.	3.4	2.6	2.5	3.5	3.2
Total tobacco produced:						
1979	1,000 lb.	156,374	303,104	216,944	71,815	748,237
1972	do.	154,498	312,763	209,138	76,711	753,110

Source: From surveys by Economics, Statistics, and Cooperatives Service, USDA and data computed by Price Support and Loan Division, Agricultural Stabilization and Conservation Service, USDA.



## Holding Land and Tobacco Quotas

farm increased by 50 percent during 1972-79, as farmers expanded both tobacco and other crop acreages.

Because of the uneven topography in the Piedmont, large acreages of cropland are difficult to consolidate under one management unit. Tobacco farms in the Pee Dee-Lumber River region and the Coastal Plain contain more cropland acreage than farms in the Piedmont. The greater acreage of cropland per management unit in Georgia permits diversity in the region's agriculture.

A variety of crops in addition to tobacco were grown on the study area farms in 1979. Nearly 70 percent produced corn, over half grew soybeans, and over one-fourth produced small grains (table 3). Few farms produced cotton in 1979, and peanuts were an important enterprise only in Georgia. Soybeans were produced by over two-thirds of the farms in the Pee Dee-Lumber River and the Coastal Plain.

Comparing production of other crops on tobacco farms between 1972 and 1979, the number of farms growing soybeans rose from 43 to 55 percent. Acreage of soybeans per farm doubled. Even though corn acreage per farm increased by 70 percent, the proportion of farms growing corn fell from 77 to 69 percent. The importance of peanuts remained

relatively unchanged, while that of cotton declined significantly. Apparently it became more profitable to substitute corn and soybeans for cotton.

Slightly over half the farms reported livestock on hand at the time of the 1979 survey. Forty percent reported swine and one-fourth had cattle (table 3). Beef cattle were more prevalent in 1979 on the larger operations. The proportion reporting swine, however, varied little among size groups. A larger percentage of farmers in Georgia reported livestock, and in larger numbers, than in any other region in 1979. The proportion of farms producing livestock dropped from 68 to 53 percent during 1972-79.

## Methods of Holding Land and Tobacco Quotas

The method of land and quota control reflects the permanency of control and the types of negotiations needed to accumulate flue-cured tobacco production rights. Assurance of continued control through ownership tends to lengthen the planning period over which an investment might be amortized. Renting tends to limit this period.

**Table 2—Proportion of flue-cured tobacco farms in various acreage size groups, by region**

Acres of tobacco grown and year	Region				
	Pee Dee-Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions
	Percent				
Less than 9.0:					
1979	53	28	59	59	49
1972	60	51	71	62	62
9.0-19.9:					
1979	25	40	28	22	30
1972	24	36	23	30	28
20.0-34.9:					
1979	13	17	8	13	12
1972	10	10	5	7	7
35.0 and over:					
1979	9	15	5	6	9
1972	6	3	1	1	3

**Table 3—Percentage of flue-cured tobacco farms reporting various crop and livestock enterprises,  
plus crop area and livestock numbers, by region**

Crop or livestock and year	Farms reporting in region					Acres or number per farm reporting in region				
	Pee Dee- Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions	Pee Dee- Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions
	Percent					Acres				
<b>Tobacco:</b>										
1979	100	100	100	100	100	13.2	18.8	10.8	11.5	13.8
1972	100	100	100	100	100	10.9	11.2	7.7	8.7	9.5
<b>Corn:</b>										
1979	73	80	53	94	69	40	69	16	105	53
1972	78	86	63	98	77	22	32	8	92	31
<b>Soybeans:</b>										
1979	67	80	30	50	55	111	63	30	156	77
1972	72	61	20	27	43	62	26	20	73	38
<b>Peanuts:</b>										
1979	2	7	0	48	8	22	67	0	22	34
1972	3	10	0	45	9	34	22	0	22	22
<b>Cotton:</b>										
1979	1	1	0	2	1	261	75	0	146	129
1972	22	6	1	17	8	65	14	13	40	44
<b>Small grains:</b>										
1979	12	24	43	12	28	44	28	19	31	24
1972	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
<b>Cropland available:</b>										
1979	—	—	—	—	—	129	153	47	221	114
1972	—	—	—	—	—	107	78	34	183	76
<b>Beef:</b>						Number on hand				
<b>Cows—2 years old or older</b>										
1979	13	19	18	48	20	13	17	17	25	18
1972	12	16	30	56	25	N.A.	N.A.	N.A.	N.A.	N.A.
<b>Slaughter or fat cattle</b>										
1979	2	4	3	4	3	6	7	11	20	10
1972	5	4	7	13	6	N.A.	N.A.	N.A.	N.A.	N.A.
<b>Cattle, all types</b>										
1979	14	25	20	49	24	22	21	25	43	27
1972	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

See notes at end of table.

Continued—

**Table 3—Percentage of flue-cured tobacco farms reporting various crop and livestock enterprises,  
plus crop area and livestock numbers, by region—continued**

Crop or livestock and year	Farms reporting in region					Acres or number reporting in region				
	Pee Dee- Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions	Pee Dee- Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions
	----- Percent -----					----- Number on hand -----				
Swine:										
Brood sows and boars										
1979	28	29	12	63	26	15	15	13	20	16
1972	40	42	14	68	33	N.A.	N.A.	N.A.	N.A.	N.A.
Feeder pigs										
1979	38	29	11	56	27	35	52	29	71	48
1972	22	41	18	31	28	N.A.	N.A.	N.A.	N.A.	N.A.
Market hogs										
1979	21	27	28	31	26	52	39	10	95	36
1972	32	34	27	58	33	N.A.	N.A.	N.A.	N.A.	N.A.
Hogs, all types										
1979	45	38	35	67	41	63	79	22	121	64
1972	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Livestock, all types										
1979	52	53	47	79	53	N.A.	N.A.	N.A.	N.A.	N.A.
1972	61	68	66	83	68	N.A.	N.A.	N.A.	N.A.	N.A.

N.A. = Not available.

— = Not applicable.

<sup>1</sup>Number on hand the day the survey was completed.

## Land Tenure

The method of holding or controlling land and quota varies among regions and changed dramatically during 1972-79. Three categories used to designate land control were: full owners who own the land they operate, part owners (who both own and rent), and full renters who rent all their land. The proportion of both full owners and full renters declined, while the proportion of operators who both owned and rented land increased substantially (table 4). Former full owners probably rented land to expand their farming operation. This shift is consistent with strategies for increased mechanization. The assurance of control of some land through ownership tends to lengthen the planning period over which investments in barns and harvesters can be amortized. However, capital requirements preclude most tobacco growers from owning all the land resources needed for a large mechanized tobacco operation.

The Piedmont and Pee Dee-Lumber River regions had the highest percentage of full owners and the lowest share of part owners in 1979. The Coastal Plain and Pee Dee-Lumber River regions accounted for the highest percentage of operators who were full renters, and the Coastal Plain had the lowest share of full owners. In Georgia, which had more cropland per farm, three-fourths of the operators were part owners.

## Quota Ownership and Control

Flue-cured tobacco quotas are assigned to specific farms. Besides owning and renting land with tobacco quota, operators can lease tobacco quota to their owned or rented land. The lessor can transfer the quota from the leasee's farm to his/her owned or rented farm.

Only 16 percent of the farm operators owned the entire tobacco quota that they produced in 1979, compared with 19 percent in 1972 (table 5). The proportion owning all quota fell in the Coastal Plain and Piedmont regions but rose in the Pee Dee-Lumber River and Georgia regions. About 27 percent rented all their quota in 1979. The remaining 57 percent used a combination of owning, renting, and leasing and transferring. The practice of renting or leasing was most prevalent in the Coastal Plain region.

Ownership of the entire quota was most prevalent among operators of the smallest tobacco acreages (table 6). Owning and renting, and owning, renting and leasing increased proportionately with larger tobacco acreages.

Unlike control of the land resource, control of tobacco quota (proportion using different combinations of owning, renting, and leasing) changed little from 1972-79. However, the amount of quota leased and rented per farm increased substantially.

## Characteristics of Operator Households

This section describes the flue-cured tobacco operators and their households in terms of age, education, farm income, and off-farm work and nonfarm earnings.

### Age

Operator age may affect decisions about expanding or contracting the size of the farm operation. An older operator may be less likely than a younger operator to expand the operation, invest in equipment, or both. Older operators, nearing retirement, would not expect to use the equipment long enough to recover the investment.

Thirty-seven percent of all operators in 1979 were 55 years of age or older (table 7). Forty-four percent of the operators were between the ages of 35 and 54, and 19 percent were not yet 35 years old. Operators were youngest in Georgia and oldest in the Pee Dee-Lumber River region. A larger proportion of operators were under 35 years old in 1979 than in 1972.

Older operators tended to produce smaller acreages of tobacco. Those 55 and over were also more likely to be full owners.

### Education

Nearly two-thirds of the operators of the largest acreages in 1979 had finished at least 12 years of school (table 8). In contrast, those with less than 8 years of formal schooling tended to operate smaller farms, particularly farms of less than 9 acres of tobacco. Seventy percent of the small operators in 1979 had less than 12 years of formal education. The

**Table 4—Proportion of flue-cured tobacco farms operated under various tenure arrangements, by region**

Tenure and year	Region				
	Pee Dee-Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions
Percent					
Full owners:					
1979	30	11	30	15	23
1972	30	20	39	32	30
Full renters:					
1979	19	21	15	9	17
1972	26	41	32	17	32
Part owners:					
1979	50	68	55	76	60
1972	43	37	27	48	35
Other: <sup>1</sup>					
1979	N.A.	N.A.	N.A.	N.A.	N.A.
1972	2	3	3	2	2

N.A. = Not available.

<sup>1</sup>Any arrangement that consists of some managed land. Managed land was included with owned or rented land in 1979.**Table 5—Distribution of flue-cured tobacco farms operated under various quota arrangements, by region**

Quota arrangement and year	Region				
	Pee Dee-Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions
Percent					
Own:					
1979	34	5	12	27	16
1972	21	16	20	21	19
Rent:					
1979	26	30	28	18	27
1972	21	31	23	18	27
Own and rent:					
1979	16	18	9	15	14
1972	15	10	10	22	12
Own and lease:					
1979	10	15	30	23	21
1972	19	11	22	26	18
Rent and lease:					
1979	3	10	7	6	7
1972	8	14	11	2	11
Own, rent, lease:					
1979	10	22	14	11	15
1972	16	16	10	7	13
Other <sup>1</sup> :					
1979	N.A.	N.A.	N.A.	N.A.	N.A.
1972	1	2	3	2	2

N.A. = Not applicable.

<sup>1</sup>Any arrangement that consists of some managed allotment. Managed allotment was included with owned or rented allotment in 1979.

average level of education rose during 1972-79 (table 8).

Age and education are correlated. The younger farmers attended school longer than older ones (table 9). As older operators retire, the proportion of operators with at least a high school education increases.

### Farm Income

The farmers surveyed reported an average of 79 percent of gross family farm sales from tobacco in 1979 (table 10). The proportion of farm receipts from tobacco varied considerably by region. Tobacco was expected to account for 47 percent of farm sales in Georgia, compared with 93 percent in the Piedmont. The proportion of the sales attributed to tobacco varied little by size of farm.

### Off-Farm Work and Nonfarm Earnings

For the four regions combined, 52 percent of the farm households reported one or more family members with off-farm employment in 1979 (table 11). About 27 percent of the operators and 29 percent of the operators' spouses worked off the farm. The proportion of farms reporting any off-farm work dropped by 4 percentage points between 1972 and 1979 (2). More spouses than operators worked off the farm in the Coastal Plain region and Georgia. It is likely that operators in these areas have less time to work off the farm, since tobacco acreages per farm are largest in the Coastal Plain and Georgia has the largest total farm acreage.

A smaller percentage of operator household members living on farms with the largest tobacco

**Table 6—Distribution of flue-cured tobacco farms operated under various quota arrangements, by acres of tobacco grown, study area**

Quota arrangement and year	Acres of tobacco grown				Average, four regions
	Less than 9.0	9.0-19.9	20.0-34.9	35.0 and over	
Percent					
Own:					
1979	30	3	1	2	16
1972	27	6	2	16	19
Rent:					
1979	29	30	20	17	27
1972	27	26	20	4	25
Own and rent:					
1979	8	18	18	25	14
1972	10	15	12	21	12
Own and lease:					
1979	23	20	18	16	21
1972	21	17	7	4	19
Rent and lease:					
1979	4	9	14	6	7
1972	9	13	16	7	10
Own, rent, lease:					
1979	6	20	29	34	15
1972	5	21	36	48	13
Other: <sup>1</sup>					
1979	N.A.	N.A.	N.A.	N.A.	N.A.
1972	2	3	7	0	2

N.A. = Not available.

<sup>1</sup>Any arrangement that consists of some managed allotment. Managed allotment was included with owned or rented allotment in 1979.

## Production Input Use

**Table 7—Distribution of flue-cured tobacco farmers, by age and acres of tobacco grown, study area**

Acres of tobacco grown and year	Age (years)			
	Under 35	35-54	55-64	65 and over
	Percent			
Less than 9.0:				
1979	17	34	30	19
1972	11	44	29	16
9.0-19.9:				
1979	25	45	23	7
1972	17	55	24	4
20.0-34.9:				
1979	15	59	23	3
1972	10	66	20	4
35.0 and over:				
1979	17	66	15	2
1972	16	57	15	12
Average, all size groups:				
1979	19	44	25	12
1972	12	48	28	12

**Table 8—Distribution of flue-cured tobacco farmers, by educational level and acres of tobacco grown, study area**

Acres of tobacco grown and year	Years of education		
	Less than 8	8-11	12 and over
	Percent		
Less than 9.0:			
1979	39	31	30
1972	45	36	19
9.0-19.9:			
1979	18	32	50
1972	29	39	32
20.0-34.9:			
1979	13	31	56
1972	29	36	35
35.0 and over:			
1979	6	30	64
1972	8	36	56
Average, all size groups:			
1979	27	31	42
1972	39	37	24

**Table 9—Distribution of flue-cured tobacco farmers, by educational level and age, study area, 1979**

Age of operator (years)	Years of education		
	Less than 8	8-11	12 and over
	Percent		
Under 35	1	18	81
35-54	27	34	39
55-64	57	36	7
65 and over	63	28	9
Average, all operators	27	31	42

acres work off the farm (table 12). The proportion of operators working off the farm declined directly with increased tobacco acreage. However, the proportion of households with spouses and other family members working off the farm was greater on farms growing 9 to 20 acres of tobacco than on those growing less than 9 acres of tobacco. This may result from a larger proportion of other family members on farms with 9 to 20 acres of tobacco being younger and better educated than those living on farms growing less than 9 acres of tobacco.

Only about 27 percent of farm operators and their spouses reported the equivalent of full-time off-farm employment (2,000 hours or more annually). About half the farm households reported off-farm employment for all family members combined that equaled full-time off-farm employment for one person.

Half the flue-cured tobacco farm families received less than \$2,500 in 1979 from nonfarm sources (table 13). Only a fifth had \$10,000 or more in nonfarm income. Nonfarm earnings were higher on farms with smaller tobacco acreages.

## Production Input Use

Curing fuel, fertilizer, and labor are three major inputs used in the production of flue-cured tobacco. Comparable data for curing fuel and fertilizer are not available for 1972.

**Table 10—Distribution of sales from various enterprises on flue-cured tobacco farms, by region, 1979<sup>1</sup>**

Enterprise	Region				
	Pee Dee- Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions
	Percent				
Flue-cured tobacco	74	75	93	47	79
Other crops	24	20	4	36	16
Livestock	2	5	3	17	5

<sup>1</sup>Farm operators' estimates of sales.**Table 11—Off-farm employment of flue-cured tobacco farm operators and family members, by region, 1979**

Family member	Region				
	Pee Dee- Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions
	Percent				
Operator	24	17	40	17	27
Spouse	21	36	32	20	29
Other family <sup>1</sup>	10	12	12	6	11
All family members	42	50	62	35	52

<sup>1</sup>Includes children, parents, and other relatives living in the household.**Table 12—Off-farm employment of flue-cured tobacco farm operators and family members, by acres of tobacco grown, 1979**

Family member	Acres of tobacco grown				Average, four regions
	Less than 9.0	9.0- 19.9	20.0- 34.9	35.0 and over	
	Percent				
Operator	34	24	17	12	27
Spouse	26	35	30	27	29
Other family <sup>1</sup>	10	14	10	5	11
All family members	53	56	46	37	52

<sup>1</sup>Includes children, parents, and other relatives living in the household.



## Preharvest Labor

### Curing Fuel Use

More than 80 percent of the fuel directly used in flue-cured tobacco production is for curing. Farmers spent an average of \$162 per acre on fuel to cure flue-cured tobacco in 1979. Three-fourths of the bulk barns and 59 percent of the conventional barns used liquefied petroleum gas for curing. Fuel oil was used in 21 percent of the bulk barns and 33 percent of the conventional barns. Diesel, kerosene, natural gas, and wood were used to cure the remainder of the flue-cured tobacco in 1979.

### Fertilizer Use

Flue-cured tobacco farmers applied an average of 92 pounds of nitrogen (N), 144 pounds of phosphorous (P<sub>2</sub>O<sub>5</sub>), and 207 pounds of potassium (K<sub>2</sub>O) per acre. Nitrogen and potassium applications were similar by region but phosphorous applications varied from 133 pounds per acre in the Piedmont to 180 pounds in Georgia.

### Changes in Labor Use

Over two-thirds of the labor used to produce flue-cured tobacco in 1979 was for harvesting and preparing the tobacco for market. The amount of harvest labor used per acre varied considerably.

The amount of labor used per acre was substantially reduced because of mechanization in preharvest, harvest, and postharvest operations. Changes in preharvest operations included greater mechanization of land preparation and cultivation, widespread use of mechanical transplanters, substantial use of sucker control chemicals, and use

of mechanical toppers. In combination, the above changes caused preharvest labor use to decline from 129 hours per acre in 1959 to 54 hours in 1979 (2).

Harvest labor use, including market preparation, declined from 187 hours per acre in 1972 to 118 hours per acre in 1979 because of a greater use of labor-saving bulk barns and mechanical harvesters. A changeover from tied to untied sales of flue-cured tobacco resulted in a drop of 75 hours per acre in post-harvest labor use in the late sixties.

In combination, these various changes caused labor used to produce flue-cured tobacco to drop from 425 hours per acre in 1965 to 172 hours per acre in 1979 (2). Increased use of bulk barns and mechanical harvesters will mean further reductions in labor used to produce flue-cured tobacco.

Labor reductions in flue-cured tobacco harvest generally affect part-time workers. The tobacco harvest season only lasts 6 to 8 weeks. As a result, the average hired worker had less than 260 hours of harvest work in 1972 and earned about \$340. More than half the hired work force were less than 18 years of age, more than two-thirds were black, and over half were female (4).

## Preharvest Labor

Labor use varies by job, size of farm, and region. Characteristics of people performing the jobs also differ.

**Table 13—Proportion of flue-cured tobacco farmers reporting nonfarm income, by acres of tobacco grown, study area, 1979**

Nonfarm income class	Acres of tobacco grown				Average, four regions
	Less than 9.0	9.0- 19.9	20.0- 34.9	35.0 and over	
Percent					
Less than \$100	36	38	40	47	38
\$100-\$999	3	4	7	6	4
\$1,000-\$2,499	8	10	7	9	8
\$2,500-\$4,999	11	9	11	10	10
\$5,000-\$9,999	21	22	14	13	20
\$10,000-\$19,999	14	9	11	9	12
\$20,000 and over	7	8	10	6	8

## Preharvest Labor Use

The 1979 survey revealed detailed information on preharvest jobs that have historically required considerable hand labor. Comparable information is not available for 1972. The jobs included plant bed preparation and care, pulling and hauling plants, transplanting, hoeing, irrigating, and topping and suckering. Sufficient information was obtained about other preharvest jobs, all requiring tractor or mechanical power, to make estimates of labor use for them.

Labor used per acre and per 100 pounds for preharvest jobs varied considerably by size of farm and region (tables 14 and 15). Farms with 35 acres of tobacco or more used only 64 percent as much labor per acre for the 6 specified jobs as those with 9 acres or less (table 15). Large farms used bigger machinery—and used it more often than hand methods—to accomplish the specified jobs. Preharvest labor use by region for the specified jobs was similar (41 to 44 hours per acre) except in the Piedmont where use averaged 56 hours per acre because farms there are smaller and more of the labor is done by family members (table 15). Also, a larger proportion of growers hoe and irrigate the tobacco crop in the Piedmont.

## Family Labor Contribution

Family members and exchange workers provided 62 percent of plant bed preparation and care labor but only 33 percent of the labor used to pull and haul plants. The family labor contribution for the specified preharvest jobs was highest in the Piedmont and lowest in the Coastal Plain and Georgia (table 16).

Much of the hired preharvest labor is for pulling, hauling, and transplanting the tobacco plants and topping and suckering. These are the most labor-intensive preharvest jobs and account for over 60 percent of all nonharvest work in flue-cured tobacco.

## Tobacco Harvest Method Characteristics

Harvest labor averages 69 percent of the total labor used to produce flue-cured tobacco. The harvest method used is a key factor in the wide variations of amount of labor used per acre to harvest the crop.

Flue-cured tobacco can be harvested by a number of methods. These differ primarily on three counts: how the tobacco leaves are pulled from the stalk, how and where they are prepared for curing, and what type of curing barn is used. Harvest systems continually change as farmers shift from labor-intensive to more capital-intensive systems.

## Tobacco Harvest Stages

Tobacco harvesting has three stages: removing leaves, preparing leaves for curing, and curing leaves. Leaves are pulled one of three ways:

- Workers (primers) walk down the tobacco rows and break off the leaves.
- Workers ride over the field on tractor-drawn or self-propelled machines (priming aids) and break off the tobacco leaves. Most priming aids have four seats for the primers, and four rows are harvested each time the priming aid makes a trip through the field.
- A mechanical harvester strips the leaves from the tobacco stalk by rotating spiraled rubber wipers attached to a movable head. Mechanical harvesters are both self-propelled and tractor drawn, one-row and two-row, and once over and multipass. Most mechanical harvesters are multipass. These machines usually remove four to six leaves per plant per trip across the field.

**Table 14—Labor used for six selected jobs on flue-cured tobacco farms, by region, 1979**

Job <sup>1</sup>	Region									
	Pee Dee- Lumber River, N.C.-S.C. 16		Coastal Plain, N.C. 17		Piedmont, N.C.-Va. 18		Georgia 29		Average, four regions	
	Hours/ acre	Hours/ 100 lbs.	Hours/ acre	Hours/ 100 lbs.	Hours/ acre	Hours/ 100 lbs.	Hours/ acre	Hours/ 100 lbs.	Hours/ acre	Hours/ 100 lbs.
Plant bed prepara- tion and care	4.5	0.22	3.0	0.16	4.3	0.24	2.2	0.11	3.6	0.19
Pull and haul plants	9.1	.45	10.6	.57	12.3	.69	6.0	.31	10.4	.55
Transplant	10.3	.51	10.0	.53	12.9	.72	11.1	.57	11.0	.59
Hoe	3.6	.18	2.1	.11	7.1	.40	5.1	.26	4.2	.22
Irrigate	.5	.03	1.1	.06	3.8	.21	2.3	.12	1.9	.10
Top and sucker	15.5	.77	15.3	.81	15.8	.89	14.2	.73	15.4	.82

<sup>1</sup>The six preharvest jobs constitute about 85 percent of all preharvest labor.

**Table 15—Labor used for various acreage size groups on flue-cured tobacco farms, by region, 1979<sup>1</sup>**

Acres of tobacco grown	Region									
	Pee Dee- Lumber River, N.C.-S.C. 16		Coastal Plain, N.C. 17		Piedmont, N.C.-Va. 18		Georgia 29		Average, four regions	
	Hours/ acre	Hours/ 100 lbs.	Hours/ acre	Hours/ 100 lbs.	Hours/ acre	Hours/ 100 lbs.	Hours/ acre	Hours/ 100 lbs.	Hours/ acre	Hours/ 100 lbs.
Less than 9.0	58.6	3.20	44.8	2.39	71.1	4.24	50.9	2.88	60.7	3.46
9.0-19.9	47.1	2.28	44.5	2.37	57.7	3.24	42.5	2.15	49.5	2.62
20.0-34.9	39.4	1.97	46.9	2.42	46.6	2.48	38.7	1.93	44.1	2.28
35.0 and over	36.9	1.75	37.2	2.01	46.6	2.59	35.9	1.80	39.1	2.06
Average, all size groups	43.5	2.16	42.1	2.24	56.2	3.15	40.9	2.10	46.5	2.47

<sup>1</sup>Includes labor for plant bed preparation and care, pulling and hauling plants, transplanting, hoeing, irrigating, and topping and suckering. These jobs constitute about 85 percent of all preharvest labor.

**Table 16—Regional breakdown of specified jobs performed on flue-cured tobacco farms, by type of worker, 1979**

Region and job	Type of worker	
	Family and exchange	Hired
	Percent	
Pee Dee-Lumber River, N.C.-S.C. 16:		
Plant bed preparation and care	58	42
Pull and haul plants	25	75
Transplant	29	71
Hoe	36	64
Irrigate	38	62
Top and sucker	29	71
Coastal Plain, N.C. 17:		
Plant bed preparation and care	50	50
Pull and haul plants	21	79
Transplant	27	73
Hoe	29	71
Irrigate	34	66
Top and sucker	27	73
Piedmont, N.C.-Va. 18:		
Plant bed preparation and care	78	22
Pull and haul plants	53	47
Transplant	58	42
Hoe	65	35
Irrigate	58	42
Top and sucker	59	41
Georgia 29:		
Plant bed preparation and care	57	43
Pull and haul plants	16	84
Transplant	23	77
Hoe	25	75
Irrigate	51	49
Top and sucker	18	82
Average, four regions:		
Plant bed preparation and care	62	38
Pull and haul plants	33	67
Transplant	38	62
Hoe	48	52
Irrigate	51	49
Top and sucker	36	64

Leaves are prepared for curing by tying them on sticks either manually or mechanically, placing them in bulk racks, or putting them in big boxes. In manual tying, the worker loops twine around the butt ends of tobacco leaves and attaches them to a stick which is then hung in the barn. Mechanical

looping is done with an automatic tying or sewing machine. The tobacco leaves and sticks are placed on a moving conveyor belt which passes them under a sewing head. The leaves are attached to the stick by stitches at the butt end.

Bulk racks are two-piece steel frames about 50 inches long and 15 inches high. Workers fill the bottom part of the frame or rack with tobacco leaves. They close the rack by forcing steel tines attached to the top part of the frame through the leaves.

Big boxes are steel containers of various dimensions in which tobacco is placed for curing. Some have partitions in the middle. They hold the equivalent of 8 to 20 bulk racks of tobacco. From 8 to 22 boxes are placed in the barn. Steel rods are generally inserted throughout the box to support the leaves.

Flue-cured tobacco is cured in either conventional or bulk barns (including box barns). Sticks of tobacco are generally cured in conventional barns and racks of tobacco in bulk barns. Conventional barns are wooden frame structures that have several layers (tiers) of wooden rails horizontal to the ground for hanging the sticks of tobacco. Bulk barns are compact structures generally holding from 84 to 153 racks of tobacco. These barns usually have two or three steel rails horizontal to the floor located on the sides of each room. Racks are placed on these rails and pushed toward the rear of the barn so that filling will be uniform. Box barns are similar to bulk barns.

Twenty-three tobacco harvest systems are identified in this report, each by a three-digit code (table 17). The first digit refers to how the leaves are pulled from the stalk (harvesting), the second to how and where the leaves are prepared for curing, and the third to the type of curing barn.

### **Conventional Barn Systems**

Conventional barn harvest systems were used for about 39 percent of the U.S. flue-cured tobacco acreage in 1979, compared with 92 percent in 1972 (2). The percentage in 1979 ranged from 18 percent in Georgia to 55 percent in the Piedmont.

**System 111:** Workers remove the tobacco leaves from the stalk, placing them on sleds or trailers. They then take the leaves to the barn, hand-loop them on sticks, and hang them in conventional

## Tobacco Harvest Methods

curing barns. Tractors have generally replaced mules in moving the leaves from the field to the barn.

Thirteen percent of the flue-cured tobacco farms continue to use this system as their major harvest system (table 18). Only 4 percent of the tobacco acreage was harvested by this method in 1979 compared with 19 percent in 1972 (2). This system is used primarily on small operating units. These units have apparently not switched to other harvest methods because of the investment required and because many of these units have enough family labor, with low opportunity costs, for much of the harvest task.

**System 131:** As in system 111, workers pull the tobacco leaves from the stalk and place them on sleds or trailers. The tobacco leaves are taken to the barn, tied by machine on sticks, and hung in a conventional curing barn. This harvest system continues to be very popular, particularly on farms with less than 20 acres of tobacco. Thirty-five percent of the farms use it as their major harvest system (table 18). Twenty-four percent of the tobacco acreage was harvested with this system in 1979, compared with 41 percent in 1972 (2). This system's popularity stems from the relatively low investment required for the tying machine, generally less than \$3,500.

**Systems 211, 221, and 231:** In each of these harvest systems, primers ride on priming aids. In system 211, the tobacco leaves are hand-looped on sticks at the barn; in system 221, the hand-looping is done on the priming aid in the field; and in system 231, the tobacco leaves are taken to the barn and machine-tied on sticks. All three systems use conventional curing barns. About 15 percent of the flue-cured farms used one of these three systems in 1979. Only

11 percent of the 1979 acreage was harvested with these systems, compared with 32 percent in 1972 (2). Larger operators are rapidly switching to bulk barn harvest systems.

### Bulk Barn Systems

A bulk barn harvest system was the major harvest system for 37 percent of the flue-cured growers in 1979. Sixty-one percent of the flue-cured acreage was cured in bulk barns, compared with 8 percent in 1972 (2).

**Systems 142 and 152:** These systems are similar in that for both, walking primers remove the leaves from the stalk and the tobacco is cured in bulk barns. They differ because with system 142 racking is done at the barn, while racking for system 152 is done in the field. Ten percent of the producers used the 142 method as their major harvest system, and 3 percent used the 152 method as their major harvest system. Seventeen percent of the 1979 flue-cured acreage was harvested with system 142, and 3 percent was harvested with system 152. Acreage harvested with these two systems has increased from 4 percent in 1972 to 20 percent in 1979.

**Systems 162 and 172:** These systems also use walking primers, but cure the tobacco in big box barns. The boxes are filled at the barn with system 162 and in the field for system 172. Only 2 percent of the 1979 acreage was harvested with these systems. These systems were not in use in 1972. Use of box barn harvest systems will likely increase in the future, but the rate of increase is likely to be slow because of curing problems by some farmers and the high level of management needed.

**Systems 242 and 252:** These systems differ from 142 and 152 in that they require priming aids. With system 242, bulk racking is done at the barn; with

**Table 17—Possible combinations of harvesting methods, curing preparation techniques, and curing methods, flue-cured tobacco farms**

Harvesting method	Curing preparation	Curing method
(1) Walking primers	(1) Hand-loop on sticks at barn	(1) Conventional barn
(2) Riding primers	(2) Hand-loop on sticks in field	(2) Bulk or big box barn
(3) One-row multipass harvester	(3) Machine tie on sticks	
(4) Two-row multipass harvester	(4) Bulk rack at barn	
(5) Once over harvester	(5) Bulk rack in field	
	(6) Fill big boxes at barn	
	(7) Fill big boxes in field	

**Table 18—Extent of use of various flue-cured tobacco harvest systems, study area, 1979**

Harvest system <sup>1</sup>	Farms <sup>2</sup>	Acres
	Percent	
Manual harvesting, conventional barns:		
Walking primers—		
111 Hand loopers	13	4
131 Tying machine	35	24
Riding primers—		
211 Barn hand loopers	3	3
221 Riding hand loopers	13	9
231 Tying machine	2	2
Manual harvesting, bulk and big box barns:		
Walking primers—		
142 Rack at barn	10	17
152 Rack in field	3	4
162 Fill boxes at barn	1	1
172 Fill boxes in field	1	1
Riding primers—		
242 Rack at barn	1	2
252 Rack in field	11	16
262 Fill boxes at barn	3	3
272 Fill boxes in field	1	1
Mechanical harvesting, bulk, and big box barns:		
One-row mechanical harvester—		
342 Rack at barn	4	8
352 Rack in field	1	2
362 Fill boxes at barn	1	2
372 Fill boxes in field	1	1
Two-row mechanical harvester—		
442 Rack at barn	1	2
452 Rack in field	3	1
462 Fill boxes at barn	3	1
472 Fill boxes in field	3	1
Once-over harvester—		
542 Rack at barn	3	3
572 Fill boxes in field	1	1

<sup>1</sup>Codes refer to harvest systems described in text.<sup>2</sup>Refers to percentage of farms that harvested over half of their tobacco acreage with the specified harvest system.<sup>3</sup>Indicates less than 0.5 percent, rounded to nearest whole number.

system 252, racking is done in the field. Twelve percent of the farms used these as their major harvest system in 1979. Eighteen percent of the tobacco acreage was harvested with these systems, compared with 4 percent in 1972.

**Systems 262 and 272:** These systems differ from 162 and 172 because they require priming aids. Only 1 percent of the 1979 acreage was harvested with these systems. They were not in use in 1972.

**Systems 342, 352, 362, and 372:** These harvest systems all use one-row, multipass mechanical harvesters to remove the leaves from the plant. A harvester cost about \$28,000 in 1979. With the most popular one-row harvester system, the leaves are racked at the barn. Other systems require racking in the field and filling boxes in the field or at the barn. The tobacco is cured in bulk or big box barns. Thirteen percent of the 1979 flue-cured tobacco acreage was harvested by one-row multipass harvesters. Only about 1 percent was harvested by these methods in 1972 (2).

**Systems 442, 452, 462, and 472:** The only difference between these systems and the mechanical harvester systems described is that the harvesters are two-row. These harvesters, not available in 1972, cost \$33,000 in 1979. Two-row mechanical harvesting systems were used to harvest about 5 percent of the 1979 tobacco acreage.

**Systems 542 and 572:** These systems require the use of one-row, once-over harvesters. With this harvest system, all the leaves are harvested with one trip through the field. The leaves are either racked at the barn or placed in big boxes in the field. Only 1 percent of the 1979 acreage was harvested by these methods. Tobacco harvested by these methods in 1972 was negligible.

### Reasons for Harvest System Variation

The 23 harvest systems described in this report require different levels of investment, labor, and management abilities. Furthermore, they require different labor skills and physical strength.

The amount of tobacco grown and the cost of labor are major factors influencing choice of harvest system. In general, capital-intensive systems are justified only for larger acreages. Other factors affecting choice of system include tradition, topography, sales promotion on equipment, and farmers' views about their future in tobacco production.

A major decision for flue-cured tobacco producers during the seventies was whether to switch from

## Harvest Labor

their current harvest system to a mechanical harvester or bulk system. These systems require greater investment but reduce labor requirements. A major influence in their decision was a comparison of the costs of the mechanical harvest or bulk barn system with the cost of present or alternative systems.

A switch to mechanical harvesters may also include changing some cultural practices such as wider rows, spacing plants closer together, better weed and sucker control, wider turnaround space at the end of rows, and the adoption of new tobacco strains to allow more efficient use of machines. Other factors to be considered include reliability of machine performance, ease of machine operation, and prospects for machine obsolescence (1).

In 1979, 19 percent of the tobacco acreage was harvested by mechanical harvesters and 61 percent was cured in bulk barns. The remainder was harvested with the more traditional labor-intensive systems.

Mechanical harvesters may have been available to harvest a larger share of the flue-cured tobacco acreage than was actually harvested mechanically in 1979. The 2,600 farm operators who used mechanical harvesters averaged 29 acres of tobacco. Assuming one harvester per farm and a capacity of 50 acres per machine, about one-third of the tobacco acreage could have been harvested mechanically. The lower acreage per machine than might be expected may have resulted from (1) lower yields in 1979 that reduced total labor needs, (2) high breakdown rates and repair costs for some mechanical harvesters, (3) cost competitive bulk barn harvest systems that do not require mechanical harvesters, and (4) the fact that many producers who mechanically harvested tobacco did not grow 50 acres nor did they custom harvest tobacco.

About 90 percent of the growers with less than 9 acres of tobacco used conventional barn harvest systems to harvest all or most of their tobacco (table 19). Conventional barn harvest systems require relatively low investments, and a higher proportion of labor can be supplied by family members than on larger farms. Furthermore, many of these small farms probably have conventional barns with additional useful life.

While the smallest growers (9 acres of tobacco or less) relied heavily on conventional barn harvest

systems, only 15 percent of the largest growers (35 acres or more) used conventional barn systems as their major harvest system (table 19). They depend more on capital-intensive systems.

Conventional barn harvest systems using tying machines were prevalent on farms with 9.0 to 19.9 acres of tobacco (table 19). Flue-cured management units with 20 to 35 acres of tobacco used mostly bulk barn systems.

Choice of system varied by region. About 63 percent of the operators in the Piedmont used tying machines as a component in their major harvest system compared with only a few in Georgia. The reason for this is unclear. Perhaps topography had an influence; compared with Georgia, the Piedmont is not as amenable to priming aids and mechanical harvesters. Some 80 percent of the growers in Georgia used priming aids and 7 percent used mechanical harvesters. Only 2 percent of the growers in the Piedmont used a priming aid and a similar percentage used mechanical harvesters.

The Pee Dee-Lumber River region continues to rely heavily on automatic tying machines and priming aids. However, most large growers in the region use bulk barns and 40 percent of the largest growers (35 acres or more) use mechanical harvesters.

The Coastal Plain displayed a large variation in harvest systems. Fifty-seven percent used major harvest systems requiring bulk barns. Sixteen percent of the growers in this region used mechanical harvesters. Nearly half the growers producing 35 acres or more used mechanical harvesters.

## Characteristics of Tobacco Farm Harvest Labor

Labor use varies by size of production unit and harvest system.

### Labor Use Per Farm

The largest flue-cured tobacco production units (35 acres of tobacco or more) used only about half as much harvest labor per 100 pounds of cured leaf as did the smallest production units (less than 9

Table 19—Distribution of flue-cured tobacco farms, by harvest system used and acres of tobacco grown, 1979<sup>1</sup>

Harvest system <sup>2</sup>	Acres of tobacco grown			
	Less than 9.0	9.0-19.9	20.0-34.9	35.0 and over
Percent				
Manual harvesting, conventional barns:				
Walking primers—				
111 Hand loopers	25	2	1	3
131 Tying machine	45	33	19	10
Riding primers—				
211 Barn hand loopers	3	3	1	3
221 Riding hand loopers	18	9	7	4
231 Tying machine	2	5	1	1
Manual harvesting, bulk and big box barns:				
Walking primers—				
142 Rack at barn	4	14	18	23
152 Rack in field	2	2	4	5
162 Fill boxes at barn	3	1	1	1
172 Fill boxes in field	3	3	1	1
Riding primers—				
242 Rack at barn	1	2	3	1
252 Rack in field	3	16	24	19
262 Fill boxes at barn	3	3	3	3
272 Fill boxes in field	3	1	1	1
Mechanical harvesting, bulk, and big box barns:				
One-row mechanical harvester—				
342 Rack at barn	3	4	11	12
352 Rack in field	3	1	2	3
362 Fill boxes at barn	3	2	2	5
372 Fill boxes in field	3	1	2	2
Two-row mechanical harvester—				
442 Rack at barn	3	1	1	5
452 Rack in field	3	1	3	3
462 Fill boxes at barn	3	3	3	1
472 Fill boxes in field	3	3	1	2
Once-over harvester—				
542 Rack at barn	3	3	3	3
572 Fill boxes in field	3	2	3	1

<sup>1</sup>The major harvest system refers to the method used to harvest most of the tobacco. Eighty-five percent of the farms used only one harvest system.<sup>2</sup>Codes refer to harvest systems as described in text.<sup>3</sup>Less than 0.5 percent.



## Harvest Labor

acres)<sup>4</sup>. This difference is the result of at least four factors:

- Larger farms tended to use more mechanized harvest systems.
- Labor apparently was managed more efficiently on large farms.
- Large farms primed their tobacco fewer times, which reduced the number of trips across the field.
- Yields per acre were higher on the large farms; some efficiency in labor use was attained because more pounds of tobacco were removed per trip across the field.

Per 100 pounds of tobacco harvested, labor use ranged from 2.0 hours for the 572 system (once-over harvester, filling big boxes in the field, big box barns) to 13.1 hours for the 111 harvest system (walking primers, hand loopers at barn, conventional barn) (table 20)<sup>5</sup>. Per acre, the range was 36 hours with the 572 system to 214 hours with the 111 system.

## Hired Labor

Workers harvest flue-cured tobacco during a continuous period of 6 to 8 weeks beginning in late June or early July in the southernmost regions. About two-thirds of the labor used in flue-cured tobacco production, excluding that for market preparation, occurs during harvest. For this reason and because several different tasks are involved, hired workers do much of the harvest work.

In 1979, nearly three-fourths of the harvest work was done by hired workers compared with about two-thirds in 1972 (table 21). Hired workers performed from 80 to 82 percent of the harvest work in the Pee Dee-Lumber River area, the Coastal Plain area, and Georgia. They did only 61 percent of this work in the Piedmont where units are smaller and hired workers are in shorter supply due to greater off-farm employment opportunities. Smaller crews were used in the Piedmont, and priming was often done in the morning and tying and hanging in the

afternoon, by the same workers. Exchange work (swap work) was also used more in this region (2).

**Table 20—Harvest labor use on flue-cured tobacco farms, by harvest system, study area, 1979<sup>1</sup>**

Harvest system <sup>2</sup>	Per acre	Per 100 pounds
Hours		
Manual harvesting, conventional barns:		
Walking primers—		
111 Hand loopers	214.2	13.06
131 Tying machine	157.5	8.97
Riding primers—		
211 Barn hand loopers	204.9	9.22
221 Riding hand loopers	166.0	8.57
231 Tying machine	158.5	8.09
Manual harvesting, bulk and big box barns:		
Walking primers—		
142 Rack at barn	97.5	5.29
152 Rack in field	102.5	5.58
162 Fill boxes at barn	95.1	5.34
172 Fill boxes in field	99.5	5.02
Riding primers—		
242 Rack at barn	114.4	6.00
252 Rack in field	98.9	4.95
262 Fill boxes at barn	125.4	5.25
272 Fill boxes in field	116.5	6.14.
Mechanical harvesting, bulk, and big box barns:		
One-row mechanical harvester—		
342 Rack at barn	65.5	3.52
352 Rack in field	84.5	4.76
362 Fill boxes at barn	52.8	2.91
372 Fill boxes in field	51.0	2.89
Two-row mechanical harvester—		
442 Rack at barn	51.8	2.57
452 Rack in field	61.5	3.58
462 Fill boxes at barn	59.9	3.40
472 Fill boxes in field	49.7	2.85
Once-over harvester—		
542 Rack at barn	55.7	2.65
572 Fill boxes in field	35.9	1.95
Average, all systems	117.8	6.26

<sup>4</sup>Harvest labor is defined as all labor, beginning with pulling of the leaves and ending with preparing the tobacco for market.

<sup>5</sup>The figures for the 572 system are based on a small number of observations. Also, removing all leaves from the stalk with one trip through the field is not fully acceptable to buying companies.

<sup>1</sup>Harvest labor is defined as the labor used for all harvest tasks beginning with priming of leaves up to and including market preparation.

<sup>2</sup>Codes refer to harvest systems as described in text.

The proportion of harvest work done by hired labor varied from 66 percent on small farms (less than 9.0 acres) to 83 percent on the largest farms (35 acres and more) (table 22). Only 50 percent of the harvest work was done by hired workers on the smallest farms in the Piedmont compared with nearly 90 percent on the largest farms in Georgia.

The amount of work performed by specific types of workers varied considerably. In the four study regions, more than 75 percent of the priming, bulk racking or box filling, and filling bulk and big box barns was done by hired workers (table 23). Yet hired workers did less than 60 percent of the tractor and automatic harvester driving. The operator typically drives the automatic harvester and the operator's children usually drive the tractor.

There was a lower proportion of hired labor for all tasks in the Piedmont. This reflects the smaller size of operation and greater reliance on family and exchange labor in this region.

**Table 21—Distribution of types of tobacco harvest workers on flue-cured tobacco farms, by region, study area<sup>1</sup>**

Region and year	Type of worker	
	Family and exchange	Hired
Percent		
Pee Dee-Lumber River:		
1979	19	81
1972	25	75
Coastal Plain:		
1979	18	82
1972	20	80
Piedmont:		
1979	39	61
1972	47	53
Georgia		
1979	20	80
1972	23	77
Average, four regions:		
1979	26	74
1972	33	67

<sup>1</sup>Excludes taking tobacco out of the barn and market preparation labor.

**Table 22—Distribution of types of tobacco harvest workers, by acres of tobacco grown and region, study area, 1979**

Acres of tobacco grown and region	Type of worker	
	Family and exchange	Hired
Percent		
Less than 9.0 acres:		
Pee Dee-Lumber River	19	81
Coastal Plain	16	84
Piedmont	49	51
Georgia	26	74
Average, four regions	34	66
9.0-19.9 acres:		
Pee Dee-Lumber River	26	74
Coastal Plain	23	77
Piedmont	41	59
Georgia	19	81
Average, four regions	30	70
20.0-34.9 acres:		
Pee Dee-Lumber River	17	83
Coastal Plain	18	82
Piedmont	32	68
Georgia	20	80
Average, four regions	22	78
35.0 acres or more:		
Pee Dee-Lumber River	15	85
Coastal Plain	14	86
Piedmont	24	76
Georgia	12	88
Average, four regions	17	83

## Family Labor

Farm operator families and exchange workers did about one-fourth of the work in harvesting flue-cured tobacco in 1979. They averaged about 31 hours of labor per acre and 428 hours per management unit (table 24). Their labor contribution varied considerably according to the amount of flue-cured tobacco grown. Four times more family labor was used per acre on the smallest farms compared with the largest farms. Total family labor per farm for harvest tended to rise as farm size increased.

## Total Harvest Labor Use

**Table 23—Distribution of types of tobacco harvest workers, by job performed, study area, 1979**

Job	Type of worker	
	Family and exchange	Hired
	Percent	
Primers	19	81
Handers and loopers	27	73
Bulk rackers and box fillers	20	80
Tractor drivers	44	56
Priming aid drivers	31	69
Automatic harvester drivers	58	42
Tying machine workers	35	65
Conventional barn hangers	30	70
Bulk and big box barn fillers	22	78
Total, all jobs <sup>1</sup>	26	74

<sup>1</sup>Excludes taking tobacco out of the barn and market preparation.

**Table 24—Family and exchange labor used to harvest flue-cured tobacco, by acres of tobacco grown, study area, 1979**

Acres of tobacco grown	Family and exchange labor <sup>1</sup>	
	Average per acre	Total per farm
	Hours	
Less than 9.0	61.7	247
9.0-19.9	40.4	525
20.0-34.9	24.4	634
35.0 and over	15.1	785
Average, all size groups	30.6	428

<sup>1</sup>Includes market preparation labor.

## Wage Rates

Flue-cured tobacco harvest workers received an average of \$2.80 per hour in the four study regions in 1979—double that of 1972 (2). Wage rates varied by type of job and region (table 25). Wage rates varied by job because of differences in skills and physical stamina needed. The rate for handers and loopers was only 86 percent that of primers. Regional variations also exist. Pee Dee-Lumber River wage

rates were only 78 percent of those in the Piedmont, where off-farm jobs probably provide more competition.

Another factor affecting wage rates is size of farm. Larger farms pay slightly higher wages (\$2.85 per hour on farms with 35 acres of tobacco or more versus \$2.74 on farms with less than 9 acres of tobacco). The reasons may be: (1) some large farms hire more labor and compete more with off-farm employers and other farmers for labor, (2) since large farms rely more heavily on hired workers, they look for dependable, high-quality labor, and (3) some large farms are covered by the Fair Labor Standards Act, requiring them to pay at least \$2.90 per hour for all jobs in 1979.<sup>6</sup>

## Total Labor Used to Harvest Flue-Cured Tobacco

The 1979 tobacco harvest in the study area took 46.8 million hours of labor, compared with 72.2 million hours in 1972 for about the same tobacco poundage. An estimated 325,000 harvest workers (including family and exchange workers) were employed in 1972 (3). Assuming that each worker worked the same hours (222 per year) as in 1972, the number of workers declined to 211,000 people by 1979, or an average drop of over 16,000 workers per year.

The proportion of harvest work (including "taking out" of the barn and market preparation) done by hired workers rose from 66 percent in 1972 to 71 percent in 1979.<sup>7</sup>

Despite technology that reduces harvest labor per acre, the increased acreage per farm and drop in the number of farms more than offset the potential increased contribution of family labor. The number of workers hired to harvest flue-cured tobacco during 1972-79 may have declined by 62,000 people and the number of operator, family, and exchange workers may have declined by 52,000 people. The estimated decline in the number of people employed in harvesting flue-cured tobacco depends on the assumption that each harvest worker works 222 hours a year in harvesting tobacco as in 1972 (3).

<sup>6</sup>The minimum wage under the Fair Labor Standards Act was increased to \$3.10 per hour effective January 1, 1980 and rose to \$3.35 per hour effective January 1, 1981.

<sup>7</sup>Hired workers include sharecroppers who are paid in kind, that is, they receive a specified percentage of the crop as payment for work performed.

The total labor used to harvest flue-cured tobacco dropped by 25.4 million hours (or 35 percent) in the study region between 1972-79. The decline occurred primarily because of the adoption of labor-saving techniques to harvest tobacco.

The worker requirements of mechanized harvest systems (mechanical harvester and bulk barn systems) are different from conventional harvest systems (table 26). The total number of hours spent at jobs such as hand-tying and looping and machine-tying has dropped, while those of bulk racking and filling bulk and big box barns have increased. The net result, however, is a reduction in labor needed.

The change to bulk barn and mechanical harvester systems eliminates the job of hand-loopers and tying-machine workers, jobs traditionally performed by females. Even so, the proportion of total harvest work performed by females showed little change during 1972-79. Females did 37 percent of the harvest work in 1979 compared with 38

percent in 1972. Apparently they are doing other jobs with the bulk systems. As in 1972, most of the harvest workers (88 percent) in 1979 were 45 years of age or younger.

The size of the work force needed to produce flue-cured tobacco is directly related to the volume of production and the level of harvest mechanization. The larger the acreage of tobacco produced, the greater the number of job opportunities available in tobacco production. Likewise, smaller quotas intensify competition among workers for available tobacco jobs.

The rate of adoption of labor-saving harvesting techniques has varied by production region. Together with differing rates of adoption, other factors such as other job opportunities, characteristics of harvest workers, and the concentration of tobacco production in the area affect the number and types of adjustments needed as tobacco harvest jobs are eliminated.

**Table 25—Average wage rate of seasonal hired workers on flue-cured tobacco farms, by harvest job and region, 1979**

Job	Region				
	Pee Dee- Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.-Va. 18	Georgia 29	Average, four regions
<i>Dollars per hour</i>					
Primers	2.48	2.99	3.14	2.38	2.90
Handers and loopers	2.17	2.69	3.12	2.27	2.50
Bulk rackers and box fillers	2.55	2.90	3.03	2.46	2.79
Tractor drivers	2.43	2.87	2.99	2.40	2.73
Priming aid drivers	2.43	2.77	2.46	2.43	2.68
Automatic harvester drivers	2.52	3.07	3.95	3.03	2.98
Tying machine workers	2.34	2.82	3.00	2.15	2.78
Conventional barn hangers	2.35	2.87	3.06	2.26	2.72
Bulk and big box barn fillers	2.51	2.91	3.22	2.54	2.83
Average, all jobs <sup>1</sup>	2.41	2.89	3.08	2.44	2.80

<sup>1</sup>Includes average of jobs listed above only. Wage rate for all jobs is weighted by hours hired for each job.

## Total Harvest Labor Use

**Table 26—Total labor used per job for harvesting flue-cured tobacco, by region<sup>1</sup>**

Job and year	Region				Total, four regions
	Pee Dee- Lumber River, N.C.-S.C. 16	Coastal Plain, N.C. 17	Piedmont, N.C.- Va. 18	Georgia 29	
	1,000 hours				
Primers:					
1972	3,679.4	7,900.2	5,633.5	1,759.6	18,972.7
1979	2,214.0	4,325.4	6,219.3	1,330.5	14,089.2
Handers and loopers:					
1972	2,450.6	5,392.7	1,860.0	1,572.1	11,275.4
1979	704.5	984.5	475.6	382.2	2,546.8
Bulk rackers and box fillers:					
1972	146.8	185.4	136.7	168.9	637.8
1979	952.2	2,259.6	1,060.9	683.6	4,956.3
Tractor drivers:					
1972	1,029.9	2,249.0	1,495.3	493.5	5,267.7
1979	874.8	1,500.9	1,243.9	378.6	3,998.2
Priming aid drivers:					
1972	137.8	288.5	28.4	146.2	600.9
1979	92.9	338.9	24.4	47.8	504.0
Automatic harvester drivers:					
1972	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>
1979	131.6	306.7	24.4	47.8	510.5
Tying machine workers:					
1972	1,432.7	3,334.3	3,783.6	70.5	8,621.1
1979	727.7	807.0	2,365.8	14.7	3,915.2
Conventional barn hangers:					
1972	1,365.8	2,977.4	1,758.4	771.6	6,873.2
1979	944.4	1,081.4	1,402.4	216.8	3,645.0
Bulk and big box barn fillers:					
1972	104.2	117.7	89.1	99.3	410.3
1979	549.6	1,565.5	609.7	441.0	3,165.8
Take out workers:					
1972	984.6	2,111.3	1,425.0	499.9	5,020.8
1979	425.8	774.7	695.1	165.4	2,061.0
Preparation for market workers:					
1972	2,500.0	5,400.2	3,375.7	1,386.1	12,662.0
1979	1,618.3	2,642.4	2,583.2	564.3	7,408.2
Other: <sup>3</sup>					
1972	390.2	834.5	283.1	313.9	1,821.7
1979	<sup>4</sup>	<sup>4</sup>	<sup>4</sup>	<sup>4</sup>	<sup>4</sup>
Total harvest labor:					
1972	14,222.0	30,791.2	19,868.8	7,281.6	72,163.6
1979	9,235.8	16,587.0	16,704.7	4,272.7	46,800.2

<sup>1</sup>Harvest labor is defined as the labor used for all harvest tasks beginning with priming of leaves up to and including market preparation.

<sup>2</sup>None identified on survey farms.

<sup>3</sup>Includes all jobs not easily categorized.

<sup>4</sup>Included with jobs previously listed.

During 1972-79, harvest labor was reduced the most in the Coastal Plain of North Carolina—the most concentrated production region. Harvest labor use declined by 46 percent in this region, from 30.8 million to 16.7 million hours (table 26). The number of harvest workers may have declined from 139,000 to 75,000 on the basis of 222 hours per worker.

The smallest drop in harvest labor use during 1972-79 was in the Piedmont of North Carolina and Virginia where labor use declined by 16 percent (table 26). Because of the rougher topography, operator units have expanded less rapidly and mechanical harvesters have been adopted at a slower rate in this region. Like the Coastal Plain, the Pee Dee-Lumber River and Georgia experienced large reductions in harvest labor use.

## Projected Harvest Labor Changes to 1985

The amount of labor used to harvest flue-cured tobacco in 1985 will depend on the amount of tobacco produced and the methods used to harvest the tobacco. The following discussion assumes that the quantity of tobacco produced in 1985 will be the same as in 1979.

A major factor that will determine how fast farmers adopt labor-saving harvesting techniques such as bulk barns and mechanical harvesters during the eighties is the extent of changes in the costs of labor, barns and harvesters, and prices received for tobacco. Another important determinant is the additional useful life of current harvest systems. The speed of adoption of technology is affected by various other factors as well, such as the dissemination of information about the innovation and the education and skill levels of the potential adopters (5).

Predicting technological change involves assessment of an extremely complicated social process. The process must be assessed in two stages: the invention (product development) and the diffusion (adoption) stages. Success in invention and development of new technology for one crop may have little correlation with the development or spread of technology in another crop. However, the general pattern of diffusion for several innovations has been similar. Early adoption was slow, followed by rapid adoption by the majority of growers,

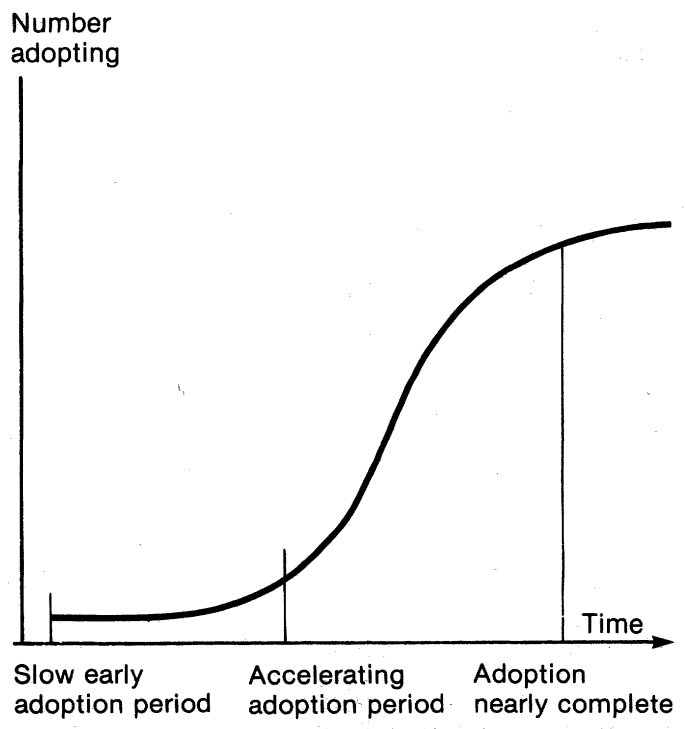
tapering off as the diffusion process neared completion (fig. 2). This S-shaped diffusion pattern has been noted for mechanical harvesting of cotton, adoption of hybrid corn, and adoption of the potato harvester. However, the adoption of processed tomato and tart cherry harvesters has been so rapid that it is almost a straight line when plotted, although it tapers off as the cycle nears completion (5).

The adoption of bulk barns appears to be following the S-shaped diffusion pattern. Adoption was slow through the sixties and early seventies, increased rapidly during the midseventies, and tapered off during the late seventies. The adoption pattern for mechanical harvesters has not been fully established. Even though 1971 was the first year harvesters were adopted, 1974 and 1975 were the peak years of adoption in North Carolina in the seventies (table 27). The adoption rates for both mechanical harvesters and bulk barns during the eighties is uncertain.

During 1972-79, the proportion of acres harvested mechanically rose by an average of about 2.6

Figure 2

### General pattern of diffusion for innovations



## References

percentage points a year. During this time period, the adoption rate for bulk barns increased an average of 7.6 percentage points a year. If the same average rate of adoption continues, about 35 percent of the flue-cured acreage will be mechanically harvested by 1985, and essentially all the tobacco will be cured in bulk barns. If this occurs, harvest labor use might decline to 34.3 million hours.<sup>a</sup>

If mechanical harvester adoption occurs more rapidly, 70 percent of the acreage is mechanically harvested, and all of it cured in bulk barns by 1985, labor use will total 28.9 million hours. These two estimates reflect labor reductions of 27 and 38 percent, respectively.

The rate of increase in adoption of mechanical harvesters slowed during 1977-79 to an average of 2 percentage points a year and to 4.6 percentage points a year for bulk barns. If the slower rate of adoption continues, 31 percent of the acreage will be mechanically harvested by 1985 and 89 percent cured in bulk barns. Harvest labor use would total 37.9 million hours—a reduction of 23 percent from 1979. Because of the large reduction in harvest labor use that has already occurred, quantity reductions in labor used to harvest flue-cured tobacco are likely to slow.

<sup>a</sup>Labor use estimates are based on mechanical harvester/bulk barn systems using an average of 61 hours of labor for harvest, with bulk barn systems using 100 hours of labor for harvest per acre, and conventional barn systems using 165 hours of labor per acre.

**Table 27—Placement of mechanical harvesters and bulk barns on flue-cured tobacco farms in North Carolina, 1970-79**

Year	Mechanical harvesters		Bulk barns	
	Number placed	Total on farms	Number placed	Total on farms
	Number			
1970	0	0	800	2,201
1971	4	4	800	3,001
1972	39	43	1,783	4,784
1973	257	300	3,987	8,771
1974	650	950	5,960	14,731
1975	800	1,750	8,800	23,531
1976	530	2,280	6,066	29,597
1977	348	2,628	2,888	32,485
1978	407	3,035	3,607	36,092
1979	378	3,413	2,289	38,381

Source: Tobacco Information, annual issues 1970-79, North Carolina State University.

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